

INTRODUCTION

The Animal and Plant Health Inspection Service (APHIS) regulates noxious weeds under the authority of the Plant Protection Act (PPA). APHIS names the regulated weeds in the noxious weed regulations (7 CFR 360) in order to ensure transparency. Listed kinds may not be imported into the United States, or moved interstate, without a special permit. APHIS uses risk assessments as a basis for weed exclusion decisions. This document presents guidelines for conducting pest-initiated, qualitative pest risk assessments specifically for determining whether or not a weed species should be listed in (or de-listed from) the noxious weed regulations.

In a qualitative assessment we estimate risk in terms such as high or low as opposed to numerical terms such as probabilities or frequencies. Plant Protection and Quarantine (PPQ) risk assessment procedures are harmonized with those of the North American Plant Protection Organization (NAPPO) and the International Plant Protection Convention (IPPC) of the United Nations Food and Agriculture Organization (FAO). Our use of biological and phytosanitary terms (*e.g.*, introduction, quarantine pest) conforms with the *NAPPO Compendium of Phytosanitary Terms* (NAPPO 1995) and the *Definitions and Abbreviations* (Introduction Section) in *International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis* (FAO 1995).

Pest risk assessment is a component of pest risk analysis. FAO (1995) guidelines describe three stages in pest risk analysis:

- Stage 1: Initiating the process by identifying a pest that may qualify as a quarantine pest, and/or pathways that may allow introduction or spread of a quarantine pest.
- Stage 2: Assessing pest risk (determining which pests are quarantine pests, characterized in terms of likelihood of entry, establishment, spread, and economic importance).
- Stage 3: Managing pest risk (developing, evaluating, comparing, and selecting options for dealing with the risk).

SUMMARY OUTLINE

This document provides a template for conducting FAO stages 1 and 2. APHIS completes eight basic steps in weed-initiated plant pest risk assessments:

Stage 1 (FAO) Initiating the process

- Step 1. Document the Initiating Event(s) for the PRA.
- Step 2. Identify and Cite Previous Risk Assessments
- Step 3. Establish Identity of Weed.

Stage 2 (FAO): Assessing pest risk

- Step 4. Verify Quarantine Pest Status: Geographic and Regulatory Criteria.
- Step 5. Assess Economic and Environmental Importance: Consequences of Introduction.
- Step 6. Assess Likelihood of Introduction.
- Step 7. Conclusion/Determine Pest Risk Potential (PRP) of Weed.
- Step 8. Document the PRA, cite references.

METHODS: PEST RISK ASSESSMENT GUIDELINES

This section provides instructions for preparing the pest risk assessment.

Stage 1: Initiating Pest Risk Analysis Process

Step 1. Document the Initiating Event(s) for the Pest Risk Assessment

A new or revised pest risk assessment for a specific weed will be required in the following situations (including, but not limited to):

- discovery of an established infestation or an outbreak of a new weed
- through research, identification of a new weed risk
- proposal from outside APHIS for listing a new weed under the Plant Protection Act
- proposal for de-listing a weed already on the list.

Step 2. Identify and Cite Previous Risk Assessments.

Identify previous pest risk assessments for the same weed or a close relative. If an existing document adequately assesses the risks in question, determine if it is entirely or partly valid. If a previous assessment is entirely valid, the risk assessment stops here.

Step 3. Establish Identity of Weed

Define the weed as a taxon that can be adequately distinguished from other taxa of the same rank. Include:

Scientific Name: Order, Family, Genus, and species. (If the weed cannot be clearly distinguished from other taxa of the same rank, the assessment stops here.)

Common name(s)

Synonym(s)

Description, morphology

Weed biology (growth, development and reproduction)

Climatic tolerance

Native and current worldwide distribution

Key characters for identification

Note: Step 3 can be created in a stand-alone format, and used as a pest data sheet. If this is done, add to the above a summary of detection and inspection methods, pest significance (i.e., economic and environmental impacts) and control/management options. Attach a separate bibliography for the data sheet.

Stage 2: Assessing Pest Risk

Step 4. Verify Quarantine Pest Status: Regulatory and Geographic Criteria

Determine whether or not the weed satisfies regulatory and geographic criteria as a quarantine pest.

Regulatory: APHIS accepts the FAO (1995) and NAPPO (1995) definition of a quarantine pest as one having “potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled” If a weed is present but not widely distributed, identify local, state, and federal control efforts for each occurrence of the species in the United States. If there are no current control efforts

in place, you may discuss and recommend an official control program in the conclusion (Step 7) of the risk assessment.

Geographic: The weed-initiated risk assessment should first establish that the weed satisfies the geographic criteria. Describe the history of introduction and the weed's current distribution in the United States. If the weed is native, or has reached the limits of its ecological range (i.e., is widely distributed), then the weed does not satisfy the definition of a quarantine pest and the pest risk assessment stops here.

Step 5. Assess Economic and Environmental Importance: Consequences of Introduction.

Estimate the economic and environmental consequences of introduction, considering "... the establishment, spread and economic importance potential in the PRA area" (FAO, 1995). The weed-initiated risk assessment should establish that the weed is of potential economic importance by considering the consequences and likelihood of introduction. In qualitative pest risk assessments, we use five Risk Elements (RE) to estimate risk. RE #1-4 focus on the consequences of introduction and RE # 5 focuses on the likelihood of introduction.

Rate the potential consequences of introduction according to RE #1-5. These elements reflect the biology of the weed and its hosts. Rate each RE, from highest (3) to lowest (0). Discuss the rationale for each rating; cite references.

RE #1: Habitat Suitability

A weed may behave in its area of introduction as it does in its native area if climatic conditions are similar. For this element, we base estimates on suitable climate and habitat conditions. For a parasitic weed, the evaluation also considers the availability of host material. To rate this RE, you may consider the U.S. "plant hardiness zones" as described by the U.S. Department of Agriculture (USDA, 1990). You may use the climate matching software CLIMEX, which is available from the Hearne Scientific Software website at www.hearne.com.au.

Assign rating as follows:

Suitable climate and habitats (and availability of host plants, if the organism is a parasitic plant) would permit the weed to survive and establish:

| Rating | Numerical Score | Explanation |
|------------|-----------------|---|
| High | 3 | In most or all of the United States (generally, in more than 4 plant hardiness zones). |
| Medium | 2 | approximately one third to two thirds of the United States (generally, in three or four plant hardiness zones). |
| Low | 1 | approximately one third or less of the United States (generally, in one or two plant hardiness zone). |
| Negligible | 0 | no potential to survive and become established in the PRA area. |

Discuss your rationale for the rating and the level of certainty.

If the quarantine weed cannot become established in the PRA area because of unsuitable climate (or lack of hosts, if the weed is a parasite), the pest risk assessment stops here.

RE #2: Spread potential after establishment, Dispersal Potential.

Discuss the biological attributes of the species that allow it to spread and identify dispersal mechanisms. For example, determine which of the following apply:

- Consistent and prolific seed production
- Rapid growth to reproductive maturity
- High germination rate under a wide range of conditions
- Ability to suppress the growth of other plants by releasing a chemical inhibitor
- Ability to persist as dormant long-lived propagules or underground parts, such as rhizomes, tubers, turions or stolons
- Seed dormancy
- Stress tolerance, including ability to resist herbicides
- Ability to colonize a wide variety of habitats
- Lack of natural control agents
- Well-developed storage tissue (for example, tap root)
- Dispersal by wind, water, machinery, animals, and/or humans

Assign rating as follows:

| Rating | Numerical score | Explanation |
|------------|-----------------|--|
| High | 3 | Weed has potential for rapid natural spread throughout its potential range in the PRA area (<i>e.g.</i> , high reproductive potential AND highly mobile propagules) |
| Medium | 2 | Weed has potential for natural spread throughout a physiographic region of the PRA area within a year (<i>e.g.</i> , it has either high reproductive potential OR highly mobile propagules). |
| Low | 1 | Weed has potential for natural spread locally in the PRA area within a year (some reproductive potential and/or some mobility of propagules). |
| Negligible | 0 | Weed has no potential for natural spread in the PRA area |

Discuss your rationale for the rating and the level of certainty.

RE #3: Economic Impact Rating

Introduced weeds can cause a variety of economic impacts. We divide these impacts into three primary categories (other types of impacts may occur):

1. Reduced crop yield (*e.g.*, by parasitism, competition, or by harboring other pests).
2. Lower commodity value (*e.g.*, by increasing costs of production, lowering market price, or a combination); or if not an agricultural weed, by increasing costs of control.
3. Loss of markets (foreign or domestic) due to presence of a new quarantine pest.

Assign ratings as follows:

| Rating | Numerical score | Explanation |
|--------|-----------------|--|
| High | 3 | Weed causes all three of the above impacts, or causes any two impacts over a wide range (over 5 types) of economic plants, plant products, or animals. |
| Medium | 2 | Weed causes any two of the above impacts, or causes any one impact |

| Rating | Numerical score | Explanation |
|------------|-----------------|--|
| | | to a wide range (over 5 types) of economic plants, plant products, or animals. |
| Low | 1 | Weed causes any one of the above impacts. |
| Negligible | 0 | Weed causes none of the above impacts. |

Discuss your rationale for the rating and the level of certainty.

RE #4: Environmental Impact

Consider whether or not the weed, if introduced, could:

- Cause impacts on ecosystem processes (alteration of hydrology, sedimentation rates, a fire regime, nutrient regimes, changes in productivity, growth, yield, vigor, etc.)
- Cause impacts on natural community composition (*e.g.*, reduce biodiversity, affect native populations, affect endangered or threatened species, impact keystone species, impact native fauna, pollinators, or microorganisms, etc.)
- Cause impacts on community structure (*e.g.*, change density of a layer, cover the canopy, eliminate or create a layer, impact wildlife habitats, etc.)
- Have impacts on human health such as allergies or changes in air or water quality.
- Have sociological impacts on recreation patterns and aesthetic or property values.
- Stimulate control programs including toxic chemical pesticides or introduction of a nonindigenous biological control agent.

Assign ratings as follows:

| Rating | Numerical Score | Explanation |
|------------|-----------------|--|
| High | 3 | Three or more of the above. (Potential to cause major damage to the environment with significant losses to plant ecosystems and subsequent physical environmental degradation.) (Population reduction of endangered or threatened species would elevate that one factor to a high rating.) |
| Medium | 2 | Two of the above. (Potential to cause moderate impact on the environment with obvious change in the ecological balance, affecting several attributes of the ecosystem, as well as moderate recreation or aesthetic impacts.) |
| Low | 1 | One of the above, unless the factor is potential to reduce populations of endangered or threatened species, which rates High. (Limited potential impact on environment.) |
| Negligible | 0 | None of the above. (No potential to degrade the environment or otherwise affect ecosystems.) |

Discuss your rationale for the rating and the level of certainty.

ECONOMIC and ENVIRONMENTAL IMPORTANCE SUMMARY: Consequences of Introduction: Cumulative Risk Element Score

Add together the numerical estimates for the four risk elements to produce an overall estimate of the Consequences of Introduction Risk Rating for the weed. The overall risk rating is used to assign a Consequences of Introduction Risk Score as follows:

| Risk: Consequences of Introduction (Sum Risk Elements #1-4) | | |
|---|-------------|------------|
| Cumulative Risk Element Score | Risk Rating | Risk Score |
| 0 - 2 | Negligible | 0 |
| 3 - 6 | Low | 1 |
| 7 - 10 | Medium | 2 |
| 11 - 12 | High | 3 |

The Consequences of Introduction Risk Rating is an indicator of the potential of the weed to become established and spread, and its potential to cause economic and environmental impacts

Step 6. Assess Likelihood of Introduction/Spread

The final stage is an assessment of introduction and spread potential, which depends on the number of pathways from the exporting country to the destination and the subsequent opportunities to spread once an organism has arrived.

Consider:

- Interest in cultivation of the species for ornament, food, medicine, or other uses.
- Evidence of previous importation
- Species prevalence in area of origin
- Potential for contamination of commodities or conveyances by the species
- Whether the species can survive under the environmental conditions of shipment
- Ease or difficulty of detection through visual inspection
- Probability of surviving existing phytosanitary procedures
- Frequency and quantity of pest movement into the PRA area by named means
- Number and frequency of shipments of contaminated commodities
- Number of individuals of the species associated with each named conveyance or commodity
- Intended use of named commodities
- Season of arrival and distribution of commodities

Assign ratings as follows:

| Rating | Numerical Score | Explanation: Introduction is |
|------------|-----------------|--|
| High | 3 | Very likely or certain, given the combination of factors above |
| Medium | 2 | Likely |
| Low | 1 | Low, but clearly possible |
| Negligible | 0 | Extremely unlikely |

Discuss the rationale for your rating and the level of certainty.

Step 7. Conclusion/Pest Risk Potential (PRP): Determine if Weed Should be Listed

Produce an estimate of the pest risk potential by considering the Consequences of Introduction and the Likelihood of Introduction using the following table as a guide. The pest risk potential will be obtained from the combination of the scores for likelihood of introduction and consequences of introduction, and will be assigned as follows: negligible, low, medium, medium-high and high:

| Likelihood of Introduction (Rating and Score) | Consequences of Introduction (Rating and Score) | Overall Pest Risk Potential |
|--|--|-----------------------------|
| Negligible (0) | Negligible (0) | Negligible |
| Negligible | Low | Negligible |
| Negligible (0) | Medium (2) | Negligible |
| Negligible (0) | High (3) | Negligible |
| Low (1) | Negligible (0) | Negligible |
| Low (1) | Low (1) | Low |
| Low (1) | Medium (2) | Low |
| Low (1) | High (3) | Low |
| Medium (2) | Negligible (0) | Negligible |
| Medium (2) | Low (1) | Low |
| Medium (2) | Medium (2) | Medium |
| Medium (2) | High (3) | Medium- High |
| High (3) | Negligible (0) | Negligible |
| High (3) | Low (1) | Low |
| High (3) | Medium (2) | Medium- High |
| High (3) | High (3) | High |

Discuss whether or not the species satisfies the definition of quarantine pest. Summarize the information from the previous six steps and discuss the rating.

Although this document focuses on risk assessment (*i.e.*, FAO Stages 1 & 2), the risk assessor may comment briefly on the related issue of risk management (FAO Stage 3). For instance, weeds with medium-high or high pest risk will likely be proposed for listing as Federal Noxious Weeds. Beyond this, the pest risk management phase is not discussed in this document.

Step 8. Document the PRA. Cite references.

Cite references in alphabetical order by author.

Minimally, consult the following, searching on the currently accepted name and synonyms:

A. Databases

The United States National Agricultural Library's index, *Bibliography of Agriculture* (printed), or its electronic equivalent, *AGRICOLA* (database available on-line or on CD-ROM with coverage beginning in 1970). Search on the accepted scientific name, synonyms, and common names. Request all relevant articles.

Commonwealth Agriculture Bureaux International's (CABI) printed abstracts (database available on-line or on CD-ROM with coverage beginning in 1972). Search on the accepted scientific name, synonyms, and common names. Request all relevant articles.

Commonwealth Agriculture Bureaux International's Crop Protection Compendium. Global Module, Second Edition. ©

CAB International, Wallingford, UK, 2000.

The Germplasm Resources Information Network (GRIN) database, which is available on the web at <http://www.ars-grin.gov/npgs/tax/index.html>

The Plant List of Accepted Nomenclature, Taxonomy, & Symbols (PLANTS) database, which is available on the world wide web at <http://plants.usda.gov/>

B. Some Key Publications to Review, among others:

Holm, L.G. et al. 1979. *A Geographic Atlas of World Weeds*.

Holm, L.G. et al. 1977. *World's Worst Weeds*.

Holm, L.G. et al. 1997. *World Weeds, Natural Histories and Distribution*.

Randall, R.P. 2002. *A Global Compendium of World Weeds*. Published by and available from R.G. and F.J. Richardson, P.O. Box 42, Mewreidith, Victoria 3333, Australia.

Reed, C.F. 1977. *Economically Important Foreign Weeds*.

Weber, E. 2003. *Invasive Plant Species of the World, a reference guide to environmental weeds*. Published by CABI Publishing, 44 Brattle Street, 4th Floor, Cambridge, MA 02138.

The floras of the areas in which the plant occurs.

Weed references for the countries in which the species has been introduced.

C. Misc.

Internet search using currently accepted scientific name, synonyms, and common name(s).

USDA, APHIS, PPQ port of entry interception records (contact National Identification Services (301) 734-5241 or (301) 734-8808 to request a report).

References for Guidelines Document

FAO. 1995. *International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis*. Secretariat of the International Plant Protection Convention of the Food and Agriculture Organization (FAO) of the United Nations. Rome, 1995.

NAPPO. 1995. *NAPPO Compendium of Phytosanitary Terms*, B.E. Hopper, NAPPO Secretariat, ed. North American Plant Protection Organization (NAPPO), Nepean, Ontario, Canada.

U.S. Department of Agriculture (USDA). 1990. USDA plant hardiness zone map. USDA-Agricultural Research Service (ARS). Miscellaneous Publication Number 1475. USDA-ARS, Washington, DC 20002